

Steven Stuart Brown

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Education

Ph.D., University of Wisconsin, Madison, WI, 1996
Thesis advisor: F. Fleming Crim
B.A., Dartmouth College, Hanover, NH, 1989
Graduated Summa Cum Laude, Phi Beta Kappa

Professional Experience

October 2005 – present
NOAA Earth System Research Laboratory, Chemical Sciences Division
Research Chemist

June 2014 – present
Department of Chemistry and Biochemistry, University of Colorado
Adjoint Professor

October 2000 – September 2005
NOAA Aeronomy Laboratory, Boulder, CO, and Cooperative Institute for
Research in the Environmental Sciences, University of Colorado
Research Scientist

October 1997-September 2000
NOAA Aeronomy Laboratory, Boulder, CO
National Research Council Senior Research Fellow with Dr. A. R. Ravishankara

Honors and Awards

NOAA Bronze Medal Award (Highest level granted by the Undersecretary for Oceans
and Atmospheres), 2018

NOAA Office of Atmospheric Research, Best Scientific Paper Award, 2017

Harold I. Schiff Lecture, York University, Toronto, Ontario, 2015

Colorado Governor's Award for High Impact Research, 2014

McElvain Lecture, University of Wisconsin, 2013

Cires Outstanding Performance Award, University of Colorado, 2003

Presidential Early Career Award for Scientists and Engineers, White House Office of
Science and Technology Policy, 2002

National Research Council Post-Doctoral Fellowship, 1997-2000

Proctor & Gamble Fellowship, University of Wisconsin, 1994 – 1995

National Science Foundation Predoctoral Fellowship, 1991-1994

University of Wisconsin University Fellowship, 1990-1991

Samuel M. McElvain Fellowship, University of Wisconsin, 1990

Elden Bennett Hartshorn Medal & AIC Award, Dartmouth College, 1989

Professional Affiliations

American Geophysical Union (AGU)
European Geophysical Union (EGU)
Royal Society of Chemistry (RSC)
American Chemical Society (ACS)
American Association for the Advancement of Science (AAAS)

Field Study Principal Investigator or Lead Scientist

Principal Investigator, NOAA Twin Otter Aircraft Deployment, “NOAA-NASA FIREX-AQ”, Boise, Idaho, July – September 2019
Lead Scientist, “Utah Winter Fine Particulate Study,” NOAA Twin Otter aircraft study in Salt Lake City, Utah, January-February 2017
Co-Principal Investigator (with Joel Thornton, University of Washington), “Wintertime Investigation of Emissions, Transport and Reactivity (WINTER),” NSF C-130 Aircraft, Langley, Virginia, February – March 2015
Lead Scientist, “Nitrogen Oxides, Aerosols and Halogens on a Tall Tower” (NACHTT) field campaign, Erie, CO, February – March 2011
Lead Scientist, “Activation of Continental Chloride by Reactive Oxides of Nitrogen in Midwinter (ACCRONIM),” Boulder, CO, February 2009

Conference Organization

Co-Organizer (with Randall Goldsmith, University of Wisconsin and Gerard Wysocki, Princeton University), 13th International Symposium on Cavity Enhanced Spectroscopy, Madison, WI, June 2019
Co-Chair (with Professor Sally Ng, Georgia Tech), Special Symposium on the Effect of NO_x and SO₂ on BVOC Oxidation and Organic Aerosol Formation, American Association for Aerosol Research Annual Conference, Portland, OR October 2016
Co-Chair (with Professor Frank Keutsch, Harvard University), Symposium on Spectroscopy in Atmospheric Chemistry, International Symposium on Molecular Spectroscopy, Champaign-Urbana, IL, June 2016
Co-Chair (with Dr. Rebecca Washenfelder, NOAA), 11th International Symposium on Cavity Enhanced Spectroscopy, Boulder, CO, June 2015
Co-Chair (with Professor Sally Ng, Georgia Tech), IGAC Workshop on Nitrate Radicals and Biogenic Hydrocarbons, Atlanta, GA, June 2015
Organizing Committee, Conference on Light Energy and the Environment, Sponsored by the Optical Society of America, Canberra, Australia, December 2014
Co-Chair (with Professor Yinon Rudich, Weizmann Institute of Science, Israel), Gordon Research Conference on Atmospheric Chemistry, Mt. Snow, VT, July 2013
Organized sessions at American Geophysical Union (AGU) Meetings, including “Air Quality in Urban Airsheds during Winter”, December 2017, “Wintertime Atmospheric Chemistry,” December 2015; “Air Quality in Asia”, December 2014; “Tropospheric Halogens: Sources, Multiphase Chemistry and Impacts, December 2011; “Day and Night Chemical Processing in Polluted Atmospheres,” December 2007.

Organized symposia at American Chemical Society (ACS) Meetings, including “Chemistry of Atmospheric Nitrogen Containing Compounds,” ACS National Meeting, San Francisco, CA, August 2014; “Atmospheric Chemistry and Climate,” ACS National Meeting, Boston, MA, August 2010.

Committee and Editorial Service

Editor, Atmospheric Chemistry and Physics, September 2013 – present
Journal reviewer within the last 5 years for Atmospheric Chemistry and Physics, Atmospheric Environment, Atmospheric Measurement Techniques, Chemical Physics Letters, Environmental Chemistry, Environmental Science & Technology, Journal of Atmospheric Chemistry, Journal of Geophysical Research, Geophysical Research Letters, Journal of Physical Chemistry, Physical Chemistry Chemical Physics, Proceedings of the National Academy of Sciences, Reviews of Scientific Instruments, Science, Science of the Total Environment
Proposal Reviewer within the last 5 years for the Department of Energy (DOE), National Aeronautics and Space Administration (NASA), National Science Foundation (NSF), National Oceanic and Atmospheric Administration (NOAA), Research Corporation, University of California, Berkeley, Deutsche Forschungsgemeinschaft (DFG – German Research Foundation), Natural Environment Research Council (NERC, Great Britain)
Service on NASA review panels, 2013, 2010, 2008

Community Service & Outreach Activities

University of Colorado “Wizards” Public Lecture for Elementary Age Children, “The Chemistry of the Atmosphere,” December 2014, 2016, 2018
Science Fair Judge, Peak to Peak High School, 2008, 2009, 2010

Senior Scientists, Post-Doctoral Fellows, Students and Sabbatical Visitors

Senior research scientists and engineers
Caroline Womack (CIRES Research Scientist at NOAA)

Current post-doctoral fellows and graduate students
Michael Robinson (CIRES research scientist at NOAA)
Zach Decker (Second year graduate student, University of Colorado, Department of Chemistry)

Previous Students and Post-Doctoral Fellows & Current Positions
Mattias Aldener (Scientist, FOI, Stockholm, Sweden)
Hans D. Osthoff (Associate Professor, University of Calgary, Calgary, Canada)
Jonathan E. Flad (Professor, Ohio State University ATI, Wooster, Ohio, USA)
Hendrik Fuchs (Research Scientist, Forschungszentrum Jülich, Germany)
Rebecca A. Washenfelder (Research Scientist III, CIRES & NOAA ESRL)
Roberto Sommariva (University of Leeds, UK)
Nicholas L. Wagner (Research Scientist II, CIRES & NOAA ESRL)
Cora J. Young (Associate Professor, York University, Toronto, Ontario, Canada)

Tara F. Kahan, jointly with Veronica Vaida (Assistant Professor, Syracuse University, Syracuse, NY, USA)

Peter M. Edwards (Research Scientist, University of York, UK)

Alexis R. Atwood (Droplet Measurement Technologies, Boulder, CO)

Kyung-Eun Min (Assistant Professor, Gwangju Institute of Technology, Korea)

Robert J. Wild (University of Innsbruck, Austria)

Dorothy Fibiger (California Air Resources Board, Sacramento, CA)

Kyle Zarzana (Research Scientist, University of Colorado, Boulder, CO)

Erin McDuffie (Graduate Student, currently at Dalhousie University, Nova Scotia, Canada)

William P. Dubé (Engineer, Currently in Auckland, NZ)

Rebecca Washenfelder (Post-doc, currently Federal Research Scientist, NOAA CSD)

Graduate Students Hosted & CU Thesis Advisors

Karl J. Feierabend (Veronica Vaida)

Daniel K. Havey (Veronica Vaida)

Ryan Thalman (Rainer Volkamer)

Kyle Zarzana (Maggie Tolbert)

Jessica Axson (Veronica Vaida)

Undergraduate Students Fellows and Home Institution

Maya R. Nunley, NOAA EPP Fellow from Clark Atlanta University, 2005

Thomal Langel, NOAA Hollings Fellow from the University of Wisconsin, 2010

Taylor Brownlee, NOAA Hollings Fellow from the University of Arizona, 2011

Reed Wommack, NOAA Hollings Fellow from Dartmouth College, 2013

Brigitte Rooney, NOAA Hollings Fellow from the University of Colorado, 2014

Maurice Roots, NOAA Hollings Fellow from Hampton University, 2018

Sabbatical Visitors

Professor Julianne L. Fry, Reed College, Portland Oregon, 2011-2012

Professor Robert McLaren, York University, Toronto, Ontario, 2011-2012

Academic Courses

University of Colorado, Chem 4511, Physical Chemistry I

Spring 2016

Spring 2018

Analytical Instrument Development

Cavity Ring Down Spectroscopy for NO₃ and N₂O₅

First *in-situ* detector for nighttime nitrogen oxides and one of the first applications of CRDS in atmospheric sensing. Instrument(s) have flown on 5 aircraft campaigns.

N. L. Wagner *et al.*, *Atmos. Meas. Tech.* **4**, 1227 (2011)

W. P. Dubé *et al.*, *Rev. Sci. Instr.* **77**, 034101 (2006)

S. S. Brown, *et al.* *Rev. Sci. Instr.* **73**, 3291 (2002)

Cavity Ring Down Spectroscopic Measurements of NO₂, NO, O₃ and NO_y

High sensitivity measurement for NO₂, and first demonstration of conversions to NO, O₃ and total reactive nitrogen (NO_y). Flown on 3 aircraft campaigns.

R. J. Wild *et al.*, *Environ. Sci. Technol.* **48**, 9609 (2014).

R. A. Washenfelder *et al.*, *Environ. Sci. Technol.* **45**, 2938 (2011).

H. Fuchs *et al.*, *Environ. Sci. Technol.* **43**, 7831 (2009).

Broadband Cavity Enhanced Spectroscopy for UV-VIS absorbing gases

Optical cavities, light emitting diodes (LED) and grating spectrometers / CCD detectors with applications to all structured UV-VIS absorbers.

R. A. Washenfelder *et al.*, *Atmos. Meas. Tech.* **9**, 41 (2016).

K. E. Min *et al.*, *Atmos. Meas. Tech.* **9**, 423 (2016).

R. A. Washenfelder, *et al.*, *Atmos. Chem. Phys.* **8**, 7779 (2008).

Aerosol Optical Properties

Broadband CES and single wavelength CRDS instruments for aerosol extinction, with spectrally resolved, high sensitivity UV aerosol extinction.

A. R. Attwood *et al.*, *Geophysical Research Letters* **41**, 7701 (2014).

R. A. Washenfelder, *et al.* *Atmos. Meas. Tech.* **6**, 861 (2013).

T. Baynard *et al.*, *Aerosol Science and Technology* **41**, 447 (Apr, 2007).

Patents

U.S. Patent Number 9804138, Measurement of Total Reactive Nitrogen NO_y, Together with NO₂, NO, and O₃, via Cavity Ring-Down Spectroscopy

External Collaborators and Research Projects

Yinon Rudich, Weizmann Institute, Israel

U.S. Israel Binational Science Foundation Grant to investigate sources of brown carbon aerosol and new instrumentation for aerosol optical properties

Joel Thornton, University of Washington, Seattle Washington

WINTER (Wintertime Investigation of Transport, Emissions and Reactivity), project co-PI supported through multi investigator NSF grant

Kelley Barsanti, UCR, Riverside, California

Nighttime chemistry of biomass burning emissions

NOAA Atmospheric Chemistry and Climate Cycle Program

Kyung-Eun Min, Gwangju Institute of Science and Technology (GIST), Korea

Nighttime Chemistry from the Seoul Tower

Peter Edwards, University of York, UK

Collaborative proposal for new instrumentation to investigate global halogen cycles through ERC program

Hendrik Fuchs, Forschungszentrum Jülich, Germany

International collaboration for studies at SAPHIR environmental chamber

Keding Lu, Peking University, China
Developing white paper for studies of nighttime chemistry in the context of major field campaigns in China

Tao Wang, Hong Kong Polytechnic University, China
Field studies of nighttime chemical processes in Hong Kong, China

Wahid Mellouki, CNRS, Orleans, France
Laboratory and field studies of nitrate radicals

Veronica Vaida, University of Colorado, Boulder, CO
Development of spectroscopic instrumentation and laboratory studies of atmospheric spectroscopy supported by CIRES innovative research proposal

Julianne Fry, Reed College, Portland, Oregon
José Jimenez, University of Colorado, Boulder, CO
Laboratory and field studies of organic aerosol and nitrate supported through NOAA NOAA Atmospheric Chemistry and Climate Cycle program

Andy Ruth, University College Cork, Ireland
Andreas Zahn, Karlsruhe Institute of Technology, Germany
Development of new instrument for measurement of N_2O_5 in the upper troposphere from CARIBIC supported by grant from the Irish National Science Foundation

Nga Lee Ng, Georgia Institute of Technology, Atlanta, GA
Organized symposia on nitrate radicals and biogenic hydrocarbons supported by IGAC. Developing white paper for field and laboratory studies of anthropogenic-biogenic interactions

Allen Goldstein, UC Berkeley, Berkeley CA
Atmospheric chemistry of indoor air, supported through grant from Sloan Foundation

Solomon Bililign, North Carolina A&T, Greensboro, NC
Atmospheric oxidation rates of sulfur
S. Brown appointed as Adjunct professor in Department of Energy and Environmental Systems to advise Ph.D. students at NC A&T

Recent and Forthcoming Presentations

- “Air Quality, Heterogeneous Chemistry and Odd Oxygen: New Insights into Urban Winter from Recent Aircraft Campaigns,” Harvard University, Atmospheric & Environmental Chemistry Seminar, September 2019
- “Applications of Cavity Enhanced Spectroscopy to Atmospheric Field Measurements and Aircraft Research,” 13th International Symposium on Cavity Enhanced Spectroscopy, Madison, Wisconsin, June 2019
- “Atmospheric Oxidation after Dark: The Unseen Interactions between Humans and the Biosphere,” University of Wisconsin-Madison, February 2019
- “First in-situ Observations of N₂O₅ and ClNO₂ in the Upper Atmosphere: Results from ATom,” American Geophysical Union Fall Meeting, Washington, D.C., December 2018
- “Odd Oxygen, Odd Nitrogen and their Role Urban Winter Atmospheric Chemistry,” Analytical Chemistry Seminar, University of Wisconsin-Madison, September 2018
- “Cavity Enhanced Spectroscopy of NO₂: Towards a New Standard for Atmospheric Reactive Nitrogen and Ozone,” Field Laser Applications in Industry and Research, Assissi, Italy, September 2018
- “Winter,” Workshop on New Directions in Gas Phase Atmospheric Chemistry, Telluride, Colorado, July 2018
- “Nighttime Radical Chemistry and Oxidation,” Peking University, Beijing, China, June 2018
- “Wintertime Reactive Nitrogen Chemistry,” Alaskan Pollution and Chemical Analysis (ALPACA) Workshop, Fairbanks, Alaska, May 2018
- “WINTER and UWFPS: Two Recent Aircraft Studies of Winter Air Quality,” Air Quality Research Subcommittee Meeting, Washington, D.C., April 2018
- “Air Quality Research in the U.S. and at the NOAA Chemical Sciences Division,” Project Meeting and International Workshop for Photochemical Air Pollution in Highly Urbanized Subtropical Regions, Hong Kong Polytechnic University, Hong Kong, China, February 2018
- “Aircraft Measurements in a Winter Boundary Layer,” American Geophysical Union Fall Meeting, New Orleans, Louisiana, December 2017
- “Nighttime Chemistry in East Asian Megacities,” 5th Annual Meeting on Regional Air Quality Modeling (5-RAQMS), Guangzhou, China, November 2017
- “A Tale of Two Basins: Winter Air Quality in Utah and the Western U.S.,” Civil & Environmental Engineering Seminar, Washington State University, Pullman, Washington, October 2017
- “Megacities, Forests and Fires: Nighttime Chemical Complexity across Different Atmospheres,” Gordon Research Conference on Atmospheric Chemistry, Sunday River, Maine, August 2017
- “Cavity Enhanced Spectroscopy for Atmospheric Chemistry in the Anthropocene,” Faraday Discussion on Chemistry in the Anthropocene, York, UK, May 2017
- “New Insights into Wintertime Atmospheric Chemistry,” Analytical Chemistry Seminar, Colorado State University, Fort Collins, Colorado, March 2017

- “Wintertime Atmospheric Chemistry: Understanding Sources of Oxidants and Particulate Matter,” University of Utah Department of Atmospheric Sciences, Salt Lake City, Utah, November 2016
- “Measurement of nitrogen oxides using cavity ring down spectroscopy,” IAGOS Meeting on Atmospheric Composition, Manchester, England, October 2016
- “Nocturnal oxidation of biogenic VOC: new insights from nighttime aircraft measurements,” Rice University, Houston, TX, September 2016
- “Nighttime Chemistry during Winter and Summer,” Workshop on New Directions in Gas Phase Atmospheric Chemistry, Telluride, CO, July 2016
- “The Air Quality Impacts of Western U.S. Oil and Gas Development,” University of Wisconsin, Madison, July 2016
- “Nitrogen Oxides in the Cold and Dark: New Directions in Winter Air Pollution,” American Chemical Society Regional Meeting, Anchorage, AK, June 2016
- “Nocturnal oxidation of biogenic VOC: new insights from nighttime aircraft measurements,” CNRS, Orleans, France, May 2016
- “The Air Quality Impacts of North American Oil and Gas Development,” Weizmann Institute of Science, Rehovot, Israel, March 2016
- “The impact of ClNO₂ on nitrogen oxides and oxidants in a global model,” American Geophysical Union Meeting, San Francisco, CA, December 2015
- “Nighttime aircraft measurements in polluted, biogenic-emitting regions: What have we learned?,” IGAC Workshop on Nitrate Radicals and Biogenic Volatile Organic Compounds, Georgia Institute of Technology, Atlanta, Georgia, June 2015
- “Constraints on Nighttime Oxidation of Biogenic Hydrocarbons from Aircraft Observations in the Southeast U.S.,” Southeast Atmosphere Study Modeling Workshop, NOAA Geophysical Fluid Dynamics Laboratory, Princeton, NJ, June 2015
- “The Atmospheric Chemistry of Winter,” Harold I. Schiff Lecture, York University, Ontario, Canada, May 2015
- “The Dark Side of Atmospheric Chemistry: A Decade of Nighttime Aircraft Measurements of NO₃ and N₂O₅,” National Institute for Environmental Research, Incheon, South Korea, May 2015
- “Photochemistry Underlying High Winter Ozone in an Oil and Gas Producing Mountain Basin,” American Geophysical Union Meeting, San Francisco, CA, December 2014
- “NOxCaRD: A Compact Cavity Ring Down Spectrometer to Measure Nitrogen Oxides and Ozone,” NIST Technology Transfer Symposium, Boulder, CO, October 2014
- “Organic Aerosol from Nocturnal Oxidation of Biogenic VOC,” American Association of Aerosol Research, 33rd Annual Conference, Orlando, FL October 2014
- “Nighttime Oxidation of Biogenic Hydrocarbons in the Residual Layer,” 13th IGAC Science Conference on Atmospheric Chemistry, Natal, Brazil, September 2014
- “Winter Ozone Photochemistry in an Oil and Gas Producing Mountain Basin,” American Chemical Society National Meeting, San Francisco, CA, August 2014
- “Nighttime Oxidation of Biogenic Hydrocarbons,” Weizmann Institute of Science, Rehovot, Isreal, April 2014
- “Nighttime Aircraft Measurements of Power Plant Plumes in the Southeast U.S.,” American Geophysical Union Meeting, San Francisco, CA, December 2013

“Emerging Issues in U.S. Air Quality,” Hong Kong Polytechnic University, November, 2013

“The Changing Face of U.S. Air Quality: Summer vs. Winter, Urban Smog vs. the Natural Gas Boom, and Why Chemical Mechanisms Matter,” McElvain Lecture in Physical Chemistry, University of Wisconsin-Madison, October 2013

“Reactive Nitrogen Measurements and Ozone Photochemistry,” UBWOS 2013 Data Workshop, Vernal, Utah, July 2013

“Radicals, Strange Radicals and the Radical Mechanisms that Make Them,” SEAS Seminar, Harvard University, March 2013.

“Atmospheric Oxidants, Winter vs. Summer,” Chemistry Seminar, Weizmann Institute of Science, Israel, January 2013.

Publications

Submitted, Discussion or In Press

208. Veres, P.R., J.A. Neuman, T.H. Bertram, E. Assaf, G.M. Wolfe, C.J. Williamson, B. Weinzierl, S. Tilmes, C. Thompson, A.B. Thamess, J.C. Schroder, A. Saiz-Lopez, A.W. Rollins, J.M. Roberts, D. Price, J. Peischl¹, B.A. Nault, K.H. Møller, D.O. Miller, S. Meinardi, Q. Li, L. J.-F., A. Kupc, H. Kjaergaard, D. Kinnison, J.L. Jimenez, C.M. Jernigan, R.S. Hornbrook, A. Hills, M. Dollner, D.A. Day, C.A. Cuevas, P. Campuzano-Jost, J. Burkholder, T.P. Bui, W.H. Brune, S.S. Brown, C.A. Brock¹, I. Bourgeois, D.R. Blake, E.C. Apel, and T.B. Ryerson, *In-situ observations reveal the importance of dimethyl sulfide autoxidation in the marine atmosphere*. Nature, 2019. **submitted**.
207. Brown, S.S., *Recent research directions in U.S. winter air quality: Progress and challenges*. EM Magazine, 2019. **submitted**.
206. Haskins, J.D., F.D. Lopez-Hilfiker, B.H. Lee, V. Shah, G.M. Wolfe, J. DiGangi, D. Fibiger, E.E. McDuffie, P. Veres, J.C. Schroder, P. Campuzano-Jost, D.A. Day, J.L. Jimenez, A. Weinheimer, T. Sparks, R.C. Cohen, T. Campos, A. Sullivan, H. Guo, R. Weber, J. Dibb, J. Greene, M. Fiddler, S. Bililign, L. Jaeglé, S.S. Brown, and J.A. Thornton, *Anthropogenic control over wintertime oxidation of atmospheric pollutants*. Geophys. Res. Lett., 2019. **submitted**.
205. Ravishankara, A.R., A.-L. Pele, Z. Li, Y. Ren, A. Zogka, V. Daële, M. Idir, S.S. Brown, M.N. Romanias, and A. Mellouki, *Atmospheric loss of nitrous oxide (N_2O) is not influenced by its potential reactions with OH and NO_3 radicals*. Phys. Chem. Chem. Phys., 2019. **submitted**.
204. Li, C.L., Q. He, A.P.S. Hettiyadura, U. Käfer, G. Shmul, D. Meidan, R. Zimmermann, S.S. Brown, C. George, A. Laskin, and Y. Rudich, *Enhancement of light absorption by brown carbon through night time NO_3 radical reactions*. PNAS, 2019. **submitted**.
203. Yu, C., Z. Wang, M. Xia, X. Fu, W. Wang, Y.J. Tham, T. Chen, P. Zheng, H. Li, Y. Shan, X. Wang, L. Xue, Y. Zhou, D. Yue, Y. Ou, J. Gao, K. Lu, S.S. Brown, Y. Zhang, and T. Wang, *Improving model representation of N_2O_5 uptake on atmospheric aerosols in China*. Environ. Sci. Technol. Lett., 2019. **submitted**.
202. Chai, J., D.J. Miller, E. Scheuer, J. Dibb, V. Selimovic, R. Yokelson, K.J. Zarzana, S.S. Brown, A.R. Koss, C. Warneke, and M. Hastings, *Isotopic characterization of nitrogen oxides (NO_x), nitrous acid ($HONO$), and nitrate (NO_3^- (p)) from laboratory biomass burning during FIREX*. Atmos. Meas. Tech. Discuss., 2019. **2019**: p. 1-32.
201. Coggon, M.M., C.Y. Lim, A.R. Koss, K. Sekimoto, B. Yuan, J.B. Gilman, D.H. Hagan, V. Selimovic, K. Zarzana, S.S. Brown, J.M. Roberts, M. Müller, R. Yokelson, A. Wisthaler, J.E. Krechmer, J.L. Jimenez, C. Cappa, J. Kroll, J. de Gouw, and C. Warneke, *OH-chemistry of non-methane organic gases (NMOG) emitted from laboratory and ambient biomass burning smoke: evaluating the influence of furans and oxygenated aromatics on ozone and secondary NMOG formation*. Atmos. Chem. Phys. Discuss., 2019. **2019**: p. 1-42.

200. Moravek, A., J.G. Murphy, A. Hrdina, J.C. Lin, C. Pennell, A. Franchin, A.M. Middlebrook, D.L. Fibiger, C.C. Womack, E.E. McDuffie, R. Martin, K. Moore, M. Baasandorj, and S.S. Brown, *Wintertime Spatial Distribution of Ammonia and its Emission Sources in the Great Salt Lake Region*. *Atmos. Chem. Phys. Discuss.*, 2019. **2019**: p. 1-28.
199. Sparks, T.L., C.J. Ebben, P.J. Wooldridge, F.D. Lopez-Hilfiker, B.H. Lee, J.A. Thornton, E.E. McDuffie, D.L. Fibiger, S.S. Brown, D.D. Montzka, A.J. Weinheimer, J.C. Schroder, P. Campuzano-Jost, J.L. Jimenez, and R.C. Cohen, *Comparison of Reactive Nitrogen Measurements from Aircraft during WINTER*. *J. Geophys. Res.*, 2019. **submitted**.

Published

198. Staudt, S., J.R. Gord, N.V. Karimova, E.E. McDuffie, S.S. Brown, R.B. Gerber, G.M. Nathanson, and T.H. Bertram, *Sulfate and Carboxylate Suppress the Formation of ClNO₂ at Atmospheric Interfaces*. *ACS Earth and Space Chemistry*, 2019. **3**(9): p. 1987-1997.
197. Haskins, J.D., B.H. Lee, F.D. Lopez-Hilfiker, Q. Peng, L. Jaeglé, J.M. Reeves, J.C. Schroder, P. Campuzano-Jost, D. Fibiger, E.E. McDuffie, J.L. Jiménez, S.S. Brown, and J.A. Thornton, *Observational Constraints on the Formation of Cl₂ From the Reactive Uptake of ClNO₂ on Aerosols in the Polluted Marine Boundary Layer*. *Journal of Geophysical Research: Atmospheres*, 2019. **124**(15): p. 8851-8869.
196. de Gouw, J.A., D.D. Parrish, S.S. Brown, P. Edwards, J.B. Gilman, M. Graus, T.F. Hanisco, J. Kaiser, F.N. Keutsch, S.W. Kim, B.M. Lerner, J.A. Neuman, J.B. Nowak, I.B. Pollack, J.M. Roberts, T.B. Ryerson, P.R. Veres, C. Warneke, and G.M. Wolfe, *Hydrocarbon Removal in Power Plant Plumes Shows Nitrogen Oxide Dependence of Hydroxyl Radicals*. *Geophysical Research Letters*, 2019. **46**(13): p. 7752-7760.
195. McDuffie, E.E., C.C. Womack, D.L. Fibiger, W.P. Dube, A. Franchin, A.M. Middlebrook, L. Goldberger, B.H. Lee, J.A. Thornton, A. Moravek, J.G. Murphy, M. Baasandorj, and S.S. Brown, *On the contribution of nocturnal heterogeneous reactive nitrogen chemistry to particulate matter formation during wintertime pollution events in Northern Utah*. *Atmos. Chem. Phys.*, 2019. **19**(14): p. 9287-9308.
194. Chen, X., D.B. Millet, H.B. Singh, A. Wisthaler, E.C. Apel, E.L. Atlas, D.R. Blake, I. Bourgeois, S.S. Brown, J.D. Crounse, J.A. de Gouw, F.M. Flocke, A. Fried, B.G. Heikes, R.S. Hornbrook, T. Mikoviny, K.E. Min, M. Müller, J.A. Neuman, D.W. O'Sullivan, J. Peischl, G.G. Pfister, D. Richter, J.M. Roberts, T.B. Ryerson, S.R. Shertz, C.R. Thompson, V. Treadaway, P.R. Veres, J. Walega, C. Warneke, R.A. Washenfelder, P. Weibring, and B. Yuan, *On the sources and sinks of atmospheric VOCs: an integrated analysis of recent aircraft campaigns over North America*. *Atmos. Chem. Phys.*, 2019. **19**(14): p. 9097-9123.
193. Green, J.R., M.N. Fiddler, J.S. Holloway, D.L. Fibiger, E.E. McDuffie, P. Campuzano-Jost, J.C. Schroder, J.L. Jimenez, A.J. Weinheimer, J. Aquino, D.D. Montzka, S.R. Hall, K. Ullmann, V. Shah, L. Jaeglé, J.A. Thornton, S. Bililign, and

- S.S. Brown, *Rates of Wintertime Atmospheric SO₂ Oxidation based on Aircraft Observations during Clear-Sky Conditions over the Eastern United States*. Journal of Geophysical Research: Atmospheres, 2019. **124**(12): p. 6630-6649.
192. Womack, C.C., E.E. McDuffie, P.M. Edwards, R. Bares, J.A. de Gouw, K.S. Docherty, W.P. Dubé, D.L. Fibiger, A. Franchin, J.B. Gilman, L. Goldberger, B.H. Lee, J.C. Lin, R. Long, A.M. Middlebrook, D.B. Millet, A. Moravek, J.G. Murphy, P.K. Quinn, T.P. Riedel, J.M. Roberts, J.A. Thornton, L.C. Valin, P.R. Veres, A.R. Whitehill, R.J. Wild, C. Warneke, B. Yuan, M. Baasandorj, and S.S. Brown, *An Odd Oxygen Framework for Wintertime Ammonium Nitrate Aerosol Pollution in Urban Areas: NO_x and VOC Control as Mitigation Strategies*. Geophysical Research Letters, 2019. **46**(9): p. 4971-4979.
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